

# A survey on deep learning applied to medical images: from simple artificial neural networks to generative models

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## Abstract

Deep learning techniques, in particular generative models, have taken on great importance in medical image analysis. This paper surveys fundamental deep learning concepts related to medical image generation. It provides concise overviews of studies which use some of the latest state-of-the-art models from last years applied to medical images of different injured body areas or organs that have a disease associated with (e.g., brain tumor and COVID-19 lungs pneumonia). The motivation for this study is to offer a comprehensive overview of artificial neural networks (NNs) and deep generative models in medical imaging, so more groups and authors that are not familiar with deep learning take into consideration its use in medicine works. We review the use of generative models, such as generative adversarial networks and variational autoencoders, as techniques to achieve semantic segmentation, data augmentation, and better classification algorithms, among other purposes. In addition, a collection of widely used public medical datasets containing magnetic resonance (MR) images, computed tomography (CT) scans, and common pictures is presented. Finally, we feature a summary of the current state of generative models in medical image including key features, current challenges, and future research paths.